

On Two New Species of *Asthenosoma* from the Sea of Sagami.

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With Pl. II.

The Echinoid collection of the Science College Museum contains, amongst others, five interesting specimens referable to the genus *Asthenosoma*, of which I propose to make two new species as described below.

Asthenosoma longispinum, nov. sp.

(Figs. 1-7.)

Four specimens of this species have been obtained from a depth of 313-376 fathoms in Sagami Sea.

Test flexible, disc-shaped, flat actinally, depressed abactinally, somewhat polygonal in ambital outline. Dimensions of the largest specimens: 135 mm. in diameter and 18 mm. in height. Color of covering membrane dark red as preserved in alcohol.

Plates numerous. In a specimen of 110 mm. in diameter, there are in a vertical row: actinally, about 17 interambulacral and about 23 ambulacral plates; abactinally, about 30 interambulacral and more than 30 ambulacral plates. Plates overlapping as in other species of the genus. Between every two interambulacrals in vertical succession, there exists actinally a considerable membranous area in the middle, but abactinally this membrane is reduced to a minimum, and the plates overlap one another even in the middle of transverse sutures, although

in a very slight degree. Close to the periproct again, the overlapping just referred to is not recognizable.

Apical system (fig. 5) star-shaped, not projecting, the plates lying partly in apposition, partly separated by more or less wide membranous interspaces. The larger and peripherally situated apical plates with tubercles for pedicellariæ and secondary spines. Basals (*bas.*) wedged into interambulacrum and bearing a short membranous tube with genital opening (*g. o.*). Radials (*rad.*) separated from basals, usually with a periproctal (*per.*) between. Anals (*an.*) very small, elongated, closely packed together. Anus somewhat projecting.

Ambulacrum straight, narrower than interambulacrum (the ratio of breadths of the two being 28 to 41 at ambitus).

Ambulacral plate is composed, as determined near ambitus, of an aboral section and of a small, narrow, imperfectly calcified, adoral section situated at the middle of lower edge (fig. 6, *am.*). Closer observation shows that the former again consists of three pieces apposed together in a transverse row. A pair of pores is situated on the outermost piece of the aboral section. This pair of pores, together with two more pairs found side by side on the adoral section, forms a tolerably broad poriferous zone.—Towards the periproct the divisional lines between the pieces making up the aboral section become more and more difficult to distinguish and towards the periproct the adoral section apparently loses one of its pairs of pores, so that there now remain only two pairs of pores to each ambulacral (fig. 5, *am.*). Finally the adoral section itself is no longer recognizable as such and henceforth the row is continued to the periproct by a few, very imperfectly calcified plates, each with a single pair of pores.

Peristomal ambulacrum consists of transversely narrow plates, each with a single pair of pores. They are arranged in each peristomal ambulacrum in two regular rows reaching the mouth, between which are irregularly interposed a few other plates confined to the peristomal periphery. The pairs of pores on the two rows form a continuation of the outermost series of those of the coronal ambulacrum. Those of

interposed peristomal ambulacral plates form one or two irregular series.

Tentacles of abactinal side, as also those situated near or within the peristome, are smaller, more pointed and poorer in calcareous networks, than the remainder of those of actinal side. They are also destitute of calcareous discs present in the latter. Calcareous networks of tentacles show special concentration along two symmetrically situated lines on either side.

For the distribution and arrangement of large and small tubercles on both ambulacrum and interambulacrum, the reader is referred to figs. 3 and 4.

Ambulacral arch of the perignathic girdle encloses a somewhat triangular space. The circumferential surface of the arch shows roughness at top for insertion of retractor muscles. On the other surface there is roughness along its inner edge for insertion of the muscle characteristic of the genus. Interambulacral ridge of the girdle possesses two slight prominences. Close observation shows at once that here the ridge is formed of one or two interambulacral plates derived from each of the two rows that compose an interambulacrum, and that each limb of the arch is formed by modification of a single ambulacral plate—a condition that reminds us of what occurs in the *Cidarida*. The sutures between all the plates composing the perignathic girdle remain distinct.

Spines perforated, of four kinds: 1) long poison-spines, which are smooth, cylindrical, tapering, of reddish color; some as long as 60 mm. or more; found scattered all over abactinal side; 2) stout hoof-capped spines (fig. 7) similar to those generally found in *Phormosoma* with shaft crenulated in upper part, found on abactinal side from a short distance within ambitus and extending to peristomal margin; 3) small slender spines like poison-spines but more or less crenulated and covered with thicker membrane containing red pigment, occurring intermixed with the two foregoing kinds; 4) those found thickly crowded in proximity of peristome, densely crenulated and slightly

curved, with the concavity facing the peristome.

Pedicellariæ of two kinds: small slender-stemmed trifold ones and larger but short-stemmed cup-bearing ones. Both distributed all over coronal, periproctal, and peristomal plates.

Sphæridia large, 1 mm. in length, arranged in a single series closely inside the innermost series of tentacles, not only on actinal side but also on abactinal side up to one-fourth of the way from ambitus to periproct. Their membranous covering contains red pigment; the club-shaped calcareous body has numerous canals longitudinally traversing the neck. These open mostly on the surface of neck, while only three of them pass into the head to open there.

Branchia with branches that are either simple and finger-shaped or lobose at end. Stome pentagonal. Jaws unclosed above with epiphyses. Tooth keeled.

Amongst other points of structural differences, the present species may be readily distinguished from all other species of the genus by the presence of very long spines on the abactinal, and of hoof-capped spines on the actinal side.

Asthenosoma Ijimai, nov. sp.

(Figs. 8-12.)

The following description of this species is based on a single specimen which was purchased by Prof. IJIMA from a Jōgashima fisherman in a fresh state. It was stated that it came up sticking to the fishing net. The locality of its capture must have been not very far away from Misaki, but the exact depth is unknown, although we can safely assert that the particular kind of net used by that fisherman is never let down to a depth beyond 55 fathoms.

Test similar in shape and nature to that of *A. longispinum*, Yosh., but proportionally higher. Diameter 132 mm., height 40 mm.; color as preserved in alcohol light yellow with dark brownish spots and irregular markings.

Plates very numerous. In a vertical row of interambulacral plates

there are about 36 plates abactinally and about 26 plates actinally. The number of ambulacral plates almost twice that of interambulacrals.

Apical system (fig 11) polygonal, projecting. Anus very prominent. Anal plates (*an.*) minute, of an elongated shape, few, not reaching anal margin. Periproctal plates (*per.*) with pedicellariæ and small spines. Basal plates (*bas.*) unclosed, leaving around the genital opening (*g.o.*) a narrow membranous tract (*bas'*), containing numerous small calcareous pieces and networks and extending as far down as the 8th.—10th. plates along the median interambulacral line. Madreporic plate divided into 4 separate pieces of unequal size (*mad.*), the largest occupying the normal position. This division of madreporic plate is probably merely an individual abnormality.

Ambulacrum straight, 20 mm. wide at ambitus. The arrangement of ambulacral plates both coronal and peristomal, as also that of the pairs of pores, essentially same as in the foregoing species.

Tentacles of abactinal side pointed, containing exceedingly minute calcareous pieces in a small quantity. In the proximity of ambitus, first the inner tentacles and soon also the outer tentacles begin to be provided with calcareous discs, as are all on actinal side except those on peristome. The latter are simply provided with calcareous network.

Tubercles of both ambulacral and interambulacral areas show marked difference on actinal and abactinal sides.

Primary tubercles of interambulacrum: these appear from the 23rd. plate (counting from periproct) in the proximity of ambitus on abactinal side, corresponding to the appearance of tentacles with discs. Down to the 33rd. plate they occur on alternate plates and form a single row running close to ambulacrum (*in.*, fig. 9). From the 34th. they occur on every successive plate and form two rows down to the 42nd. plate. Plates 43rd. to 47th. have alternately two and three primary tubercles giving rise to five rows (*in.*, fig. 10). Plates 48th. to 55th. with two primary tubercles each, forming four rows. Finally, plates 56th. to 62nd. with one primary tubercle each, forming two rows.—Secondary tubercles of interambulacrum: abactinally, up to 10 in a

regular transverse row on each plate (*in.*, fig. 9). Actinally, rather irregularly scattered between primary tubercles (*in.*, fig. 10).

Primary tubercles of ambulacrum: these appear at about the same level as those of the interambulacrum, in a single interrupted row along the median ambulacral suture (*am.*, fig. 9). On actual side (*am.*, fig. 10) they occur one to each plate but so as to form two regular rows on the inside of poriferous zone. Towards the peristome, these rows become more or less interrupted.—Secondary tubercles as on interambulacral plate, only fewer.

Spines perforated, of four kinds: 1) poison-spines, which are smooth, pointed and with transverse bands of a brownish color; found all over the abactinal side, where they may be as long as 16mm., and also on the peripheral half of the actinal side, where they are mostly short and do not exceed 7 mm. in length; 2) stout, slightly bent, cylindrical spines, truncated at free end and borne on all primary tubercles, consisting of crenulated shaft and of simply striated, short, terminal segment open at end (fig. 12) as long as 22 mm., 3) shorter spines, covering the main portion of the actinal side, straight, tapering, cylindrical or slightly flattened, mostly smooth; 4) short spines on the peristome and adjoining parts, club-shaped, curved, flattened, crenulated, with thick sheath of the soft part.

Pedicellariæ of two kinds: one large and long-headed, the other small, long-stemmed and trifid.

Branchia with branches that give off numerous, closely set, lobose branchlets.

The most prominent feature by which this species can be distinguished from all known members of the genus, lies in the peculiar arrangement of the primary tubercles.

Explanation of Plate II.

Asthenosoma longispinum, Yosh.

- Fig. 1. Portion of abactinal side. Nat. size.
 2. Portion of actinal side. Nat. size.
 3. Arrangement of tubercles on abactinal side. Semi-diagrammatic. *in.* interambulacral row; *am.* ambulacral row.
 4. Arrangement of tubercles on actinal side. Semi-diagrammatic. Lettering as in foregoing figure.
 5. Portion of periproct and of adjoining coronal plates. Magnified. *an.* anal plate; *per.* periproctal plate; *bas.* basal plate; *g. o.* genital opening; *mad.* madreporic plate; *rad.* radial plate; *in.* interambulacrum; *am.* ambulacrum. Portions of plates not covered with membrane are shaded.
 6. Adjoining ambulacral (*am.*) and interambulacral (*in.*) plates near ambitus. Magnified.
 7. End of hoof-capped spine. Magnified.

Asthenosoma Ijimai, Yosh.

- Fig. 8. Portion of profile view. Nat. size.
 9. Portion of abactinal side of test, showing two rows of ambulacral (*am.*) and interambulacral (*in.*) plates. $\times 2$.
 10. Portion of actinal side of test, showing two rows of ambulacral (*am.*) and interambulacral (*in.*) plates. $\times 2$.
 11. Portion of periproct and of adjoining coronal plates. Magnified. Lettering as in fig. 5.
 12. Terminal portion of primary spines, showing the terminal segment and a small portion of the crenulated shaft. Magnified.